

Vorpal Simulation of E-Cloud in MI, Status Report, Dec 17 2009

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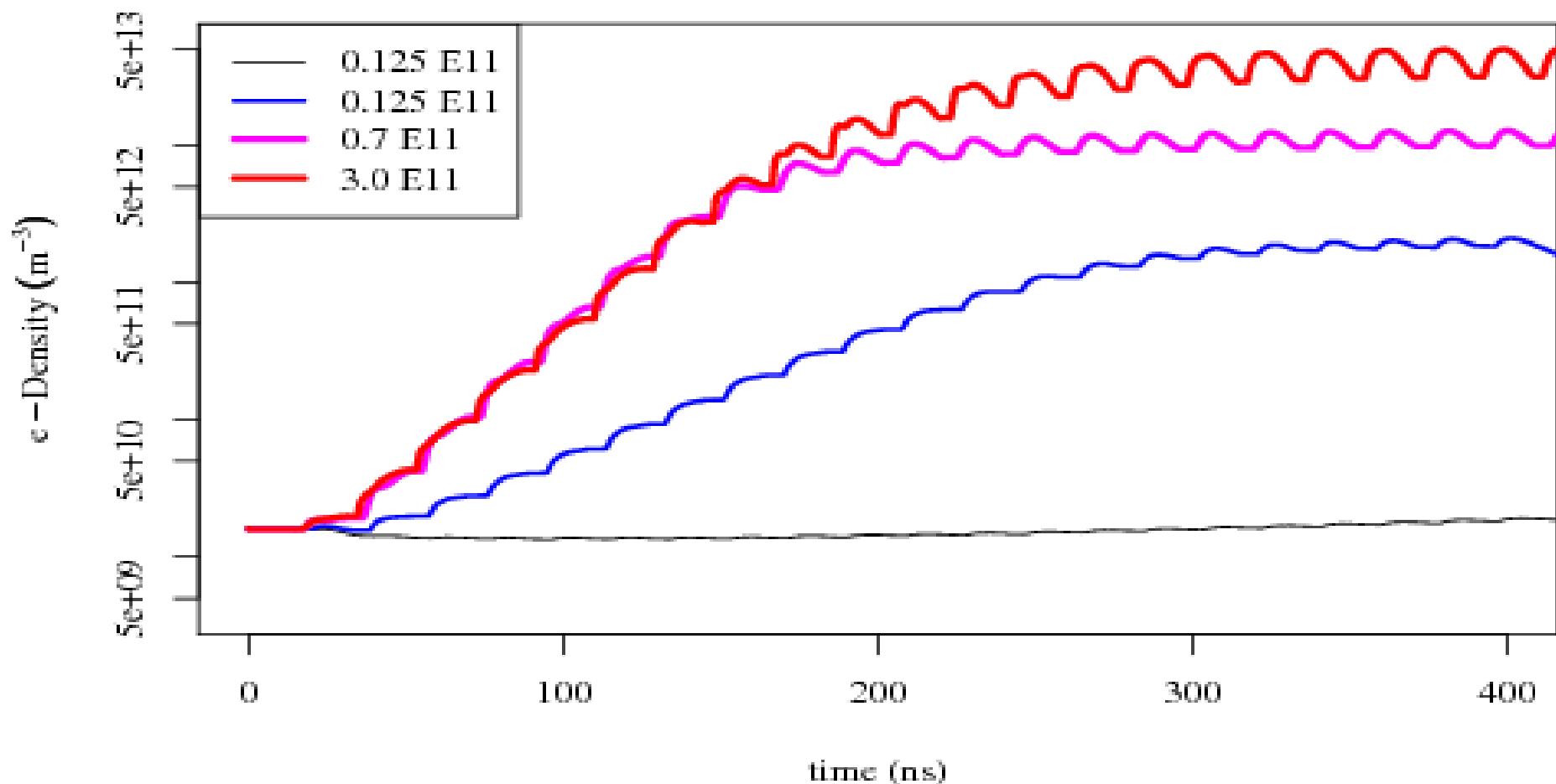
VORPAL-r12862, results.

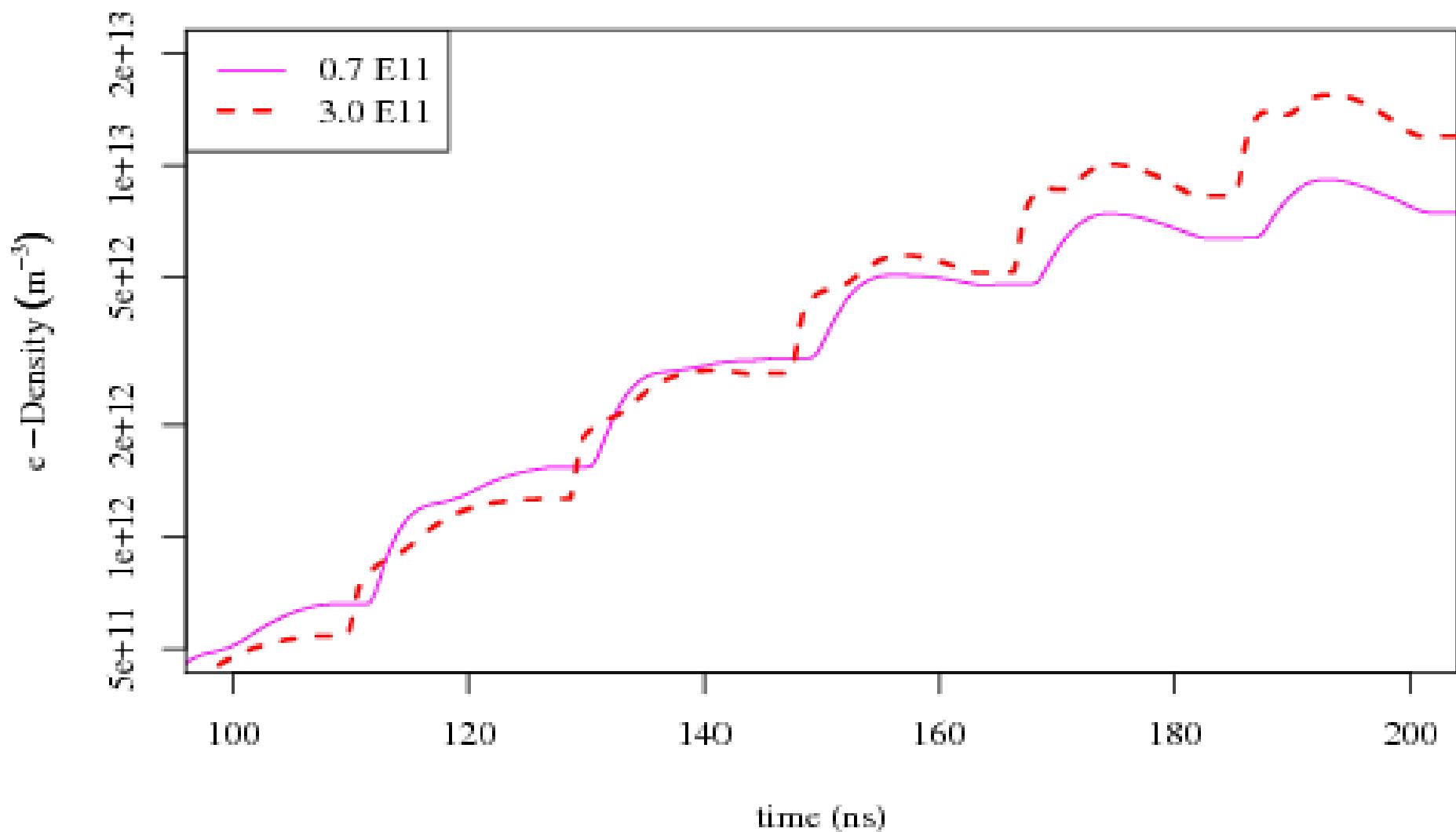
- Accurate, local profiles of e-density vs time and positions
 - Obtained on Techx system, 16 cores, 2 physical nodes.
 - Small system, smaller problem.. (25 cm. Long pipe)
 - Transcript of a letter send to TechX collab., last week.
- PAC09 erratum: Amplitude Modulation expected to be small
 - But not always, proposal for specific measurements.
- Next steps.

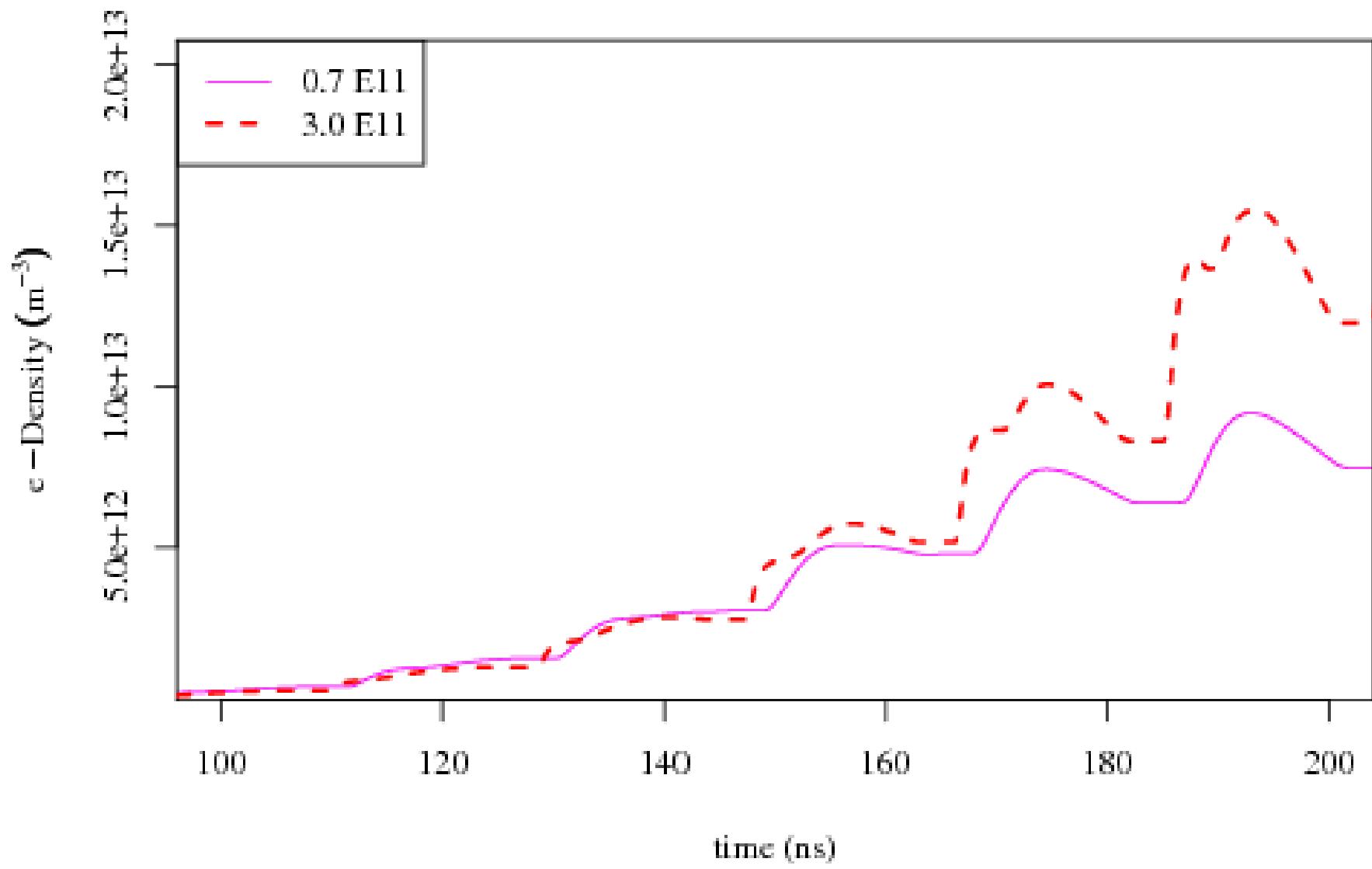
Brief recap of the setup:

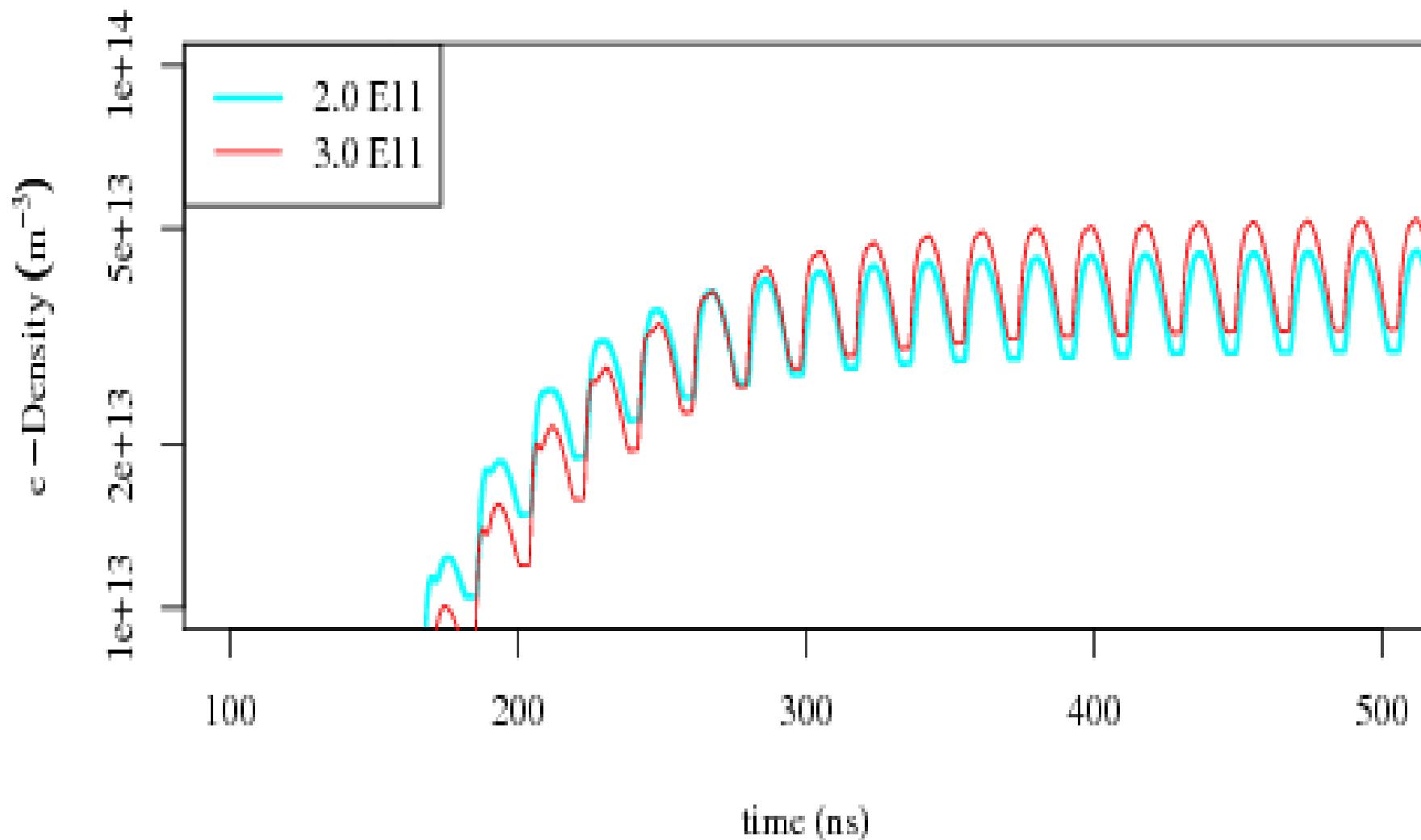
- Elliptical beam pipe (.0239 by .0588 m.) 25 to 50 cm. Long
- Stainless steel
- Grid size: 96x48x48, t-step = 3.12 ps., Fields Yee/Dey-Mittra
- Bunch size : 0.3 m long, (1 σ)
- Dipole field ~ .234 T,
- No microwave, for now...
- Assumed initial density : $2.5 \text{ e}11 \text{ e/m}^3$

E-Density vs time, 1rst train.

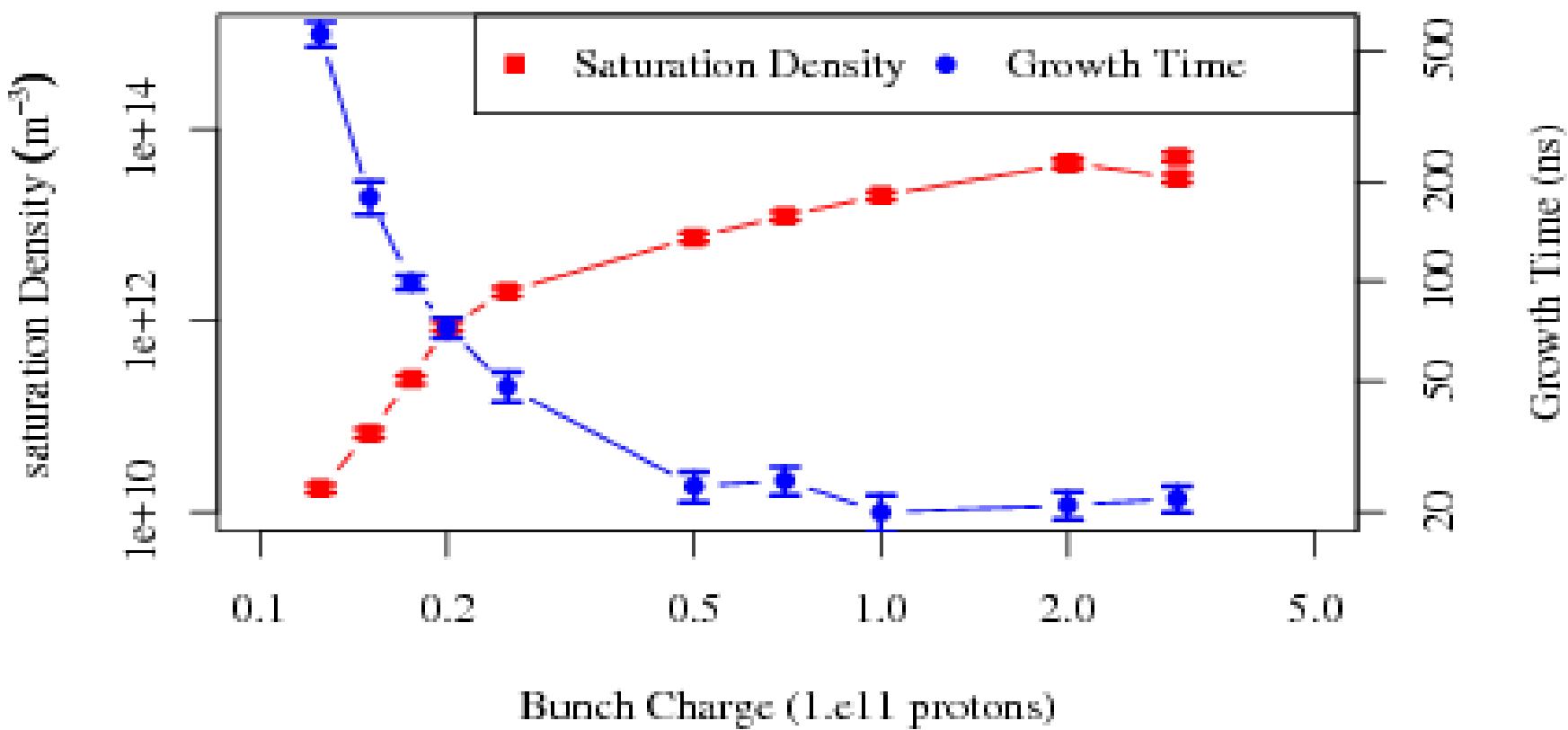




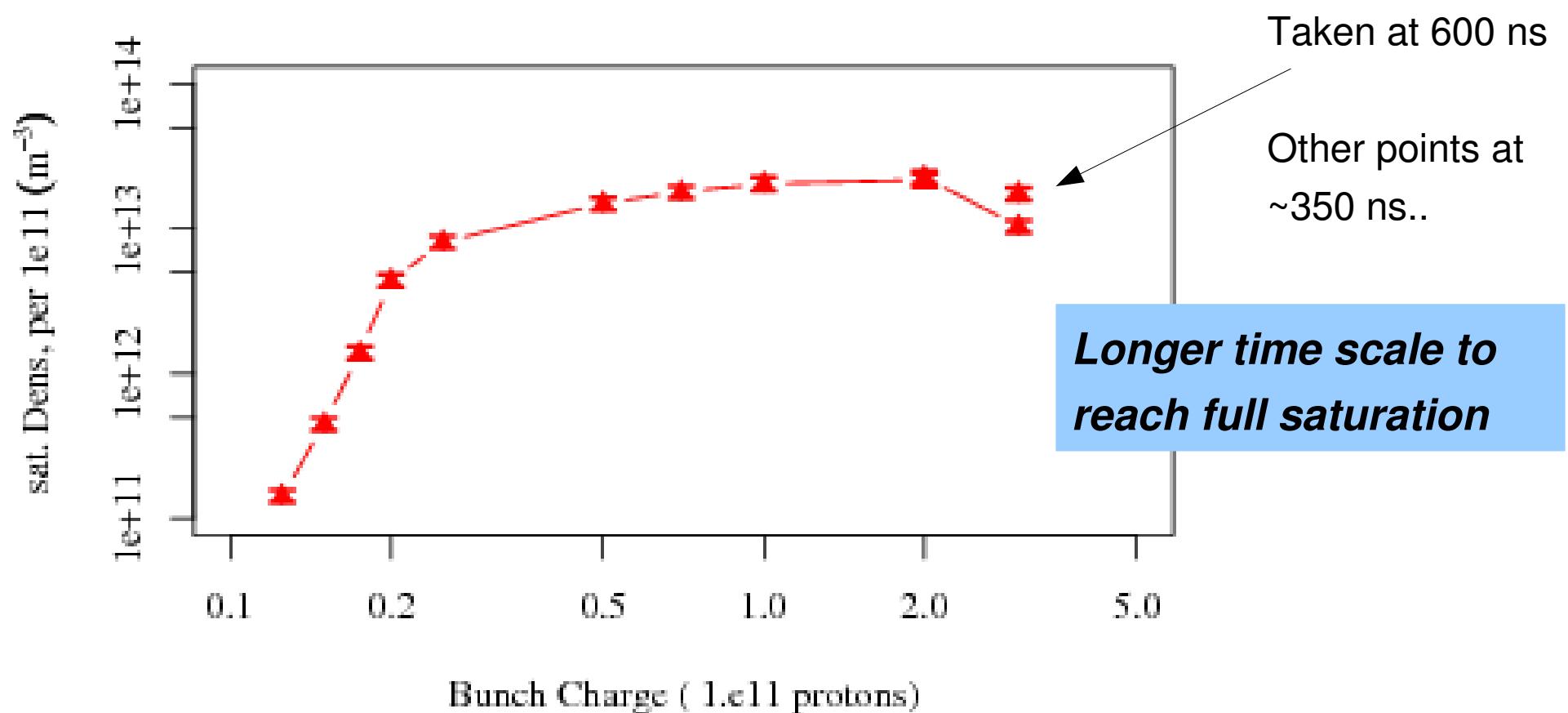




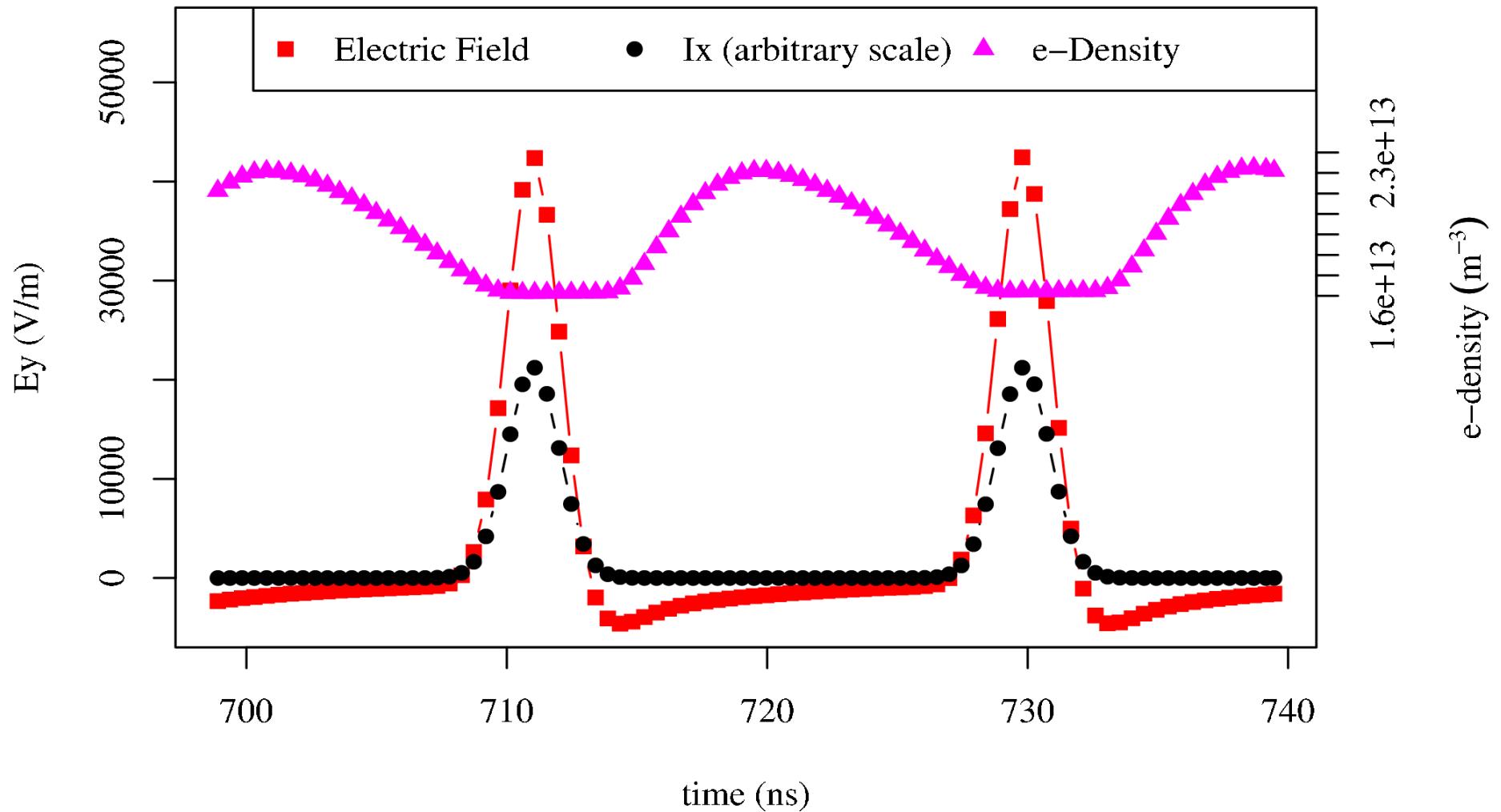
Saturation density and growth time.

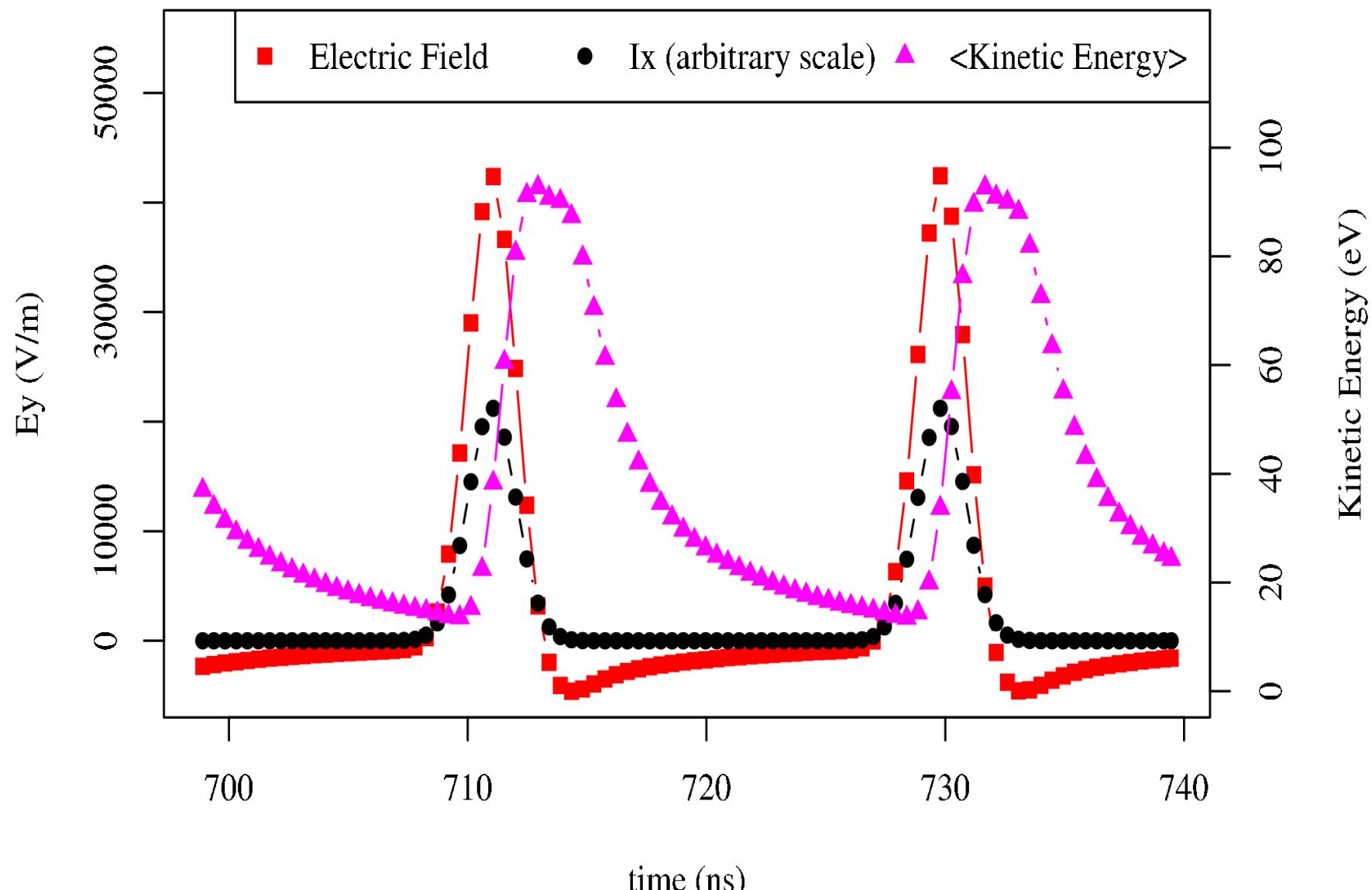


Saturation, normalized to proton charge.

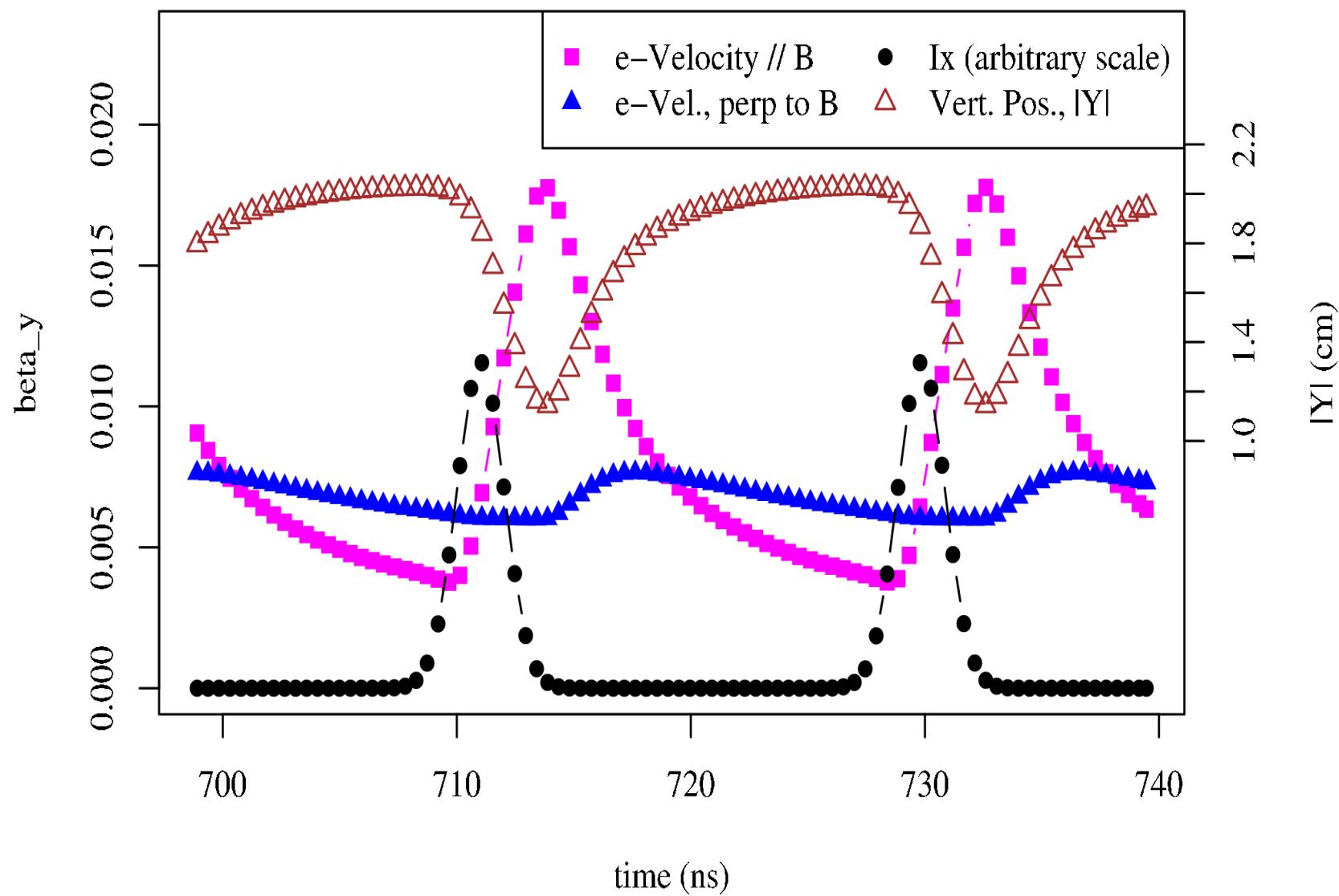


In details... 1 bunch time scale, at 1.0e11/bunch

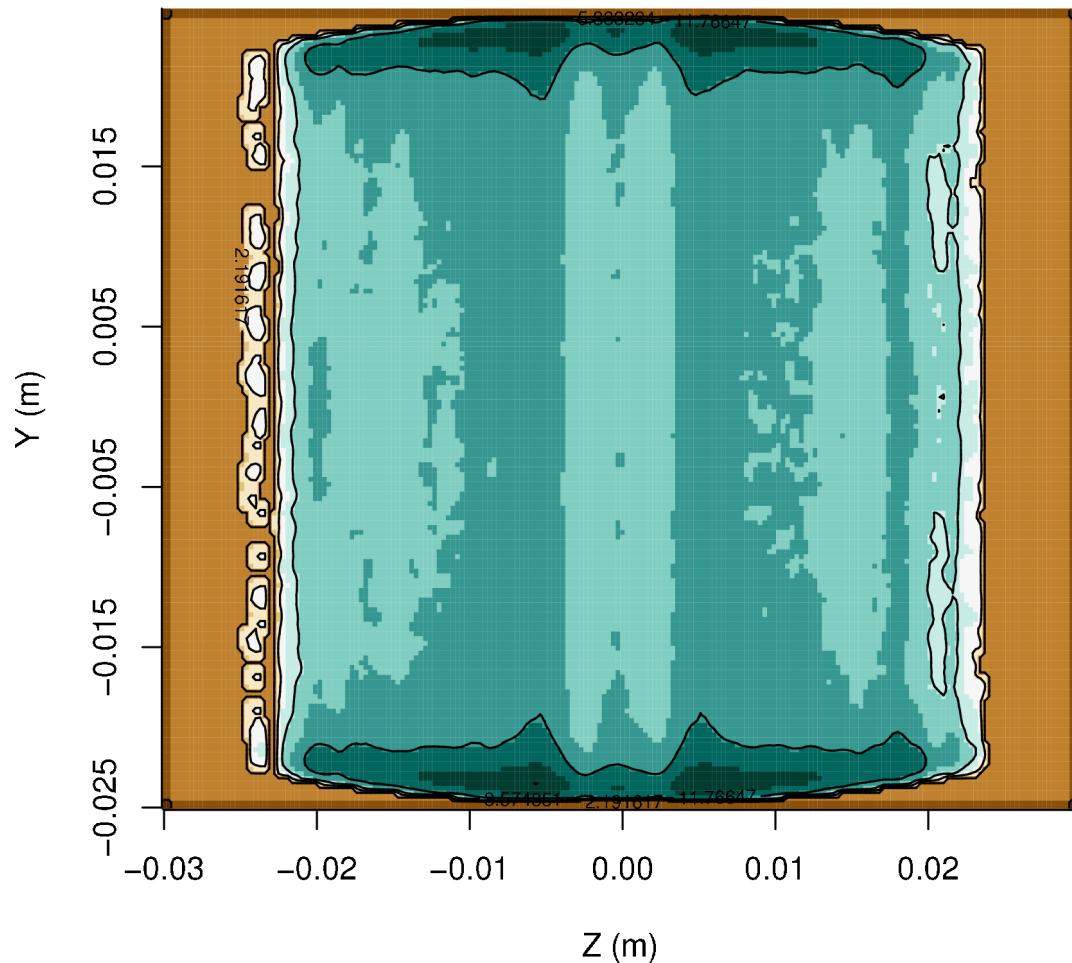




Electric field (E_y) at ~ 3 sigma from the beam axis.



Transverse Profiles

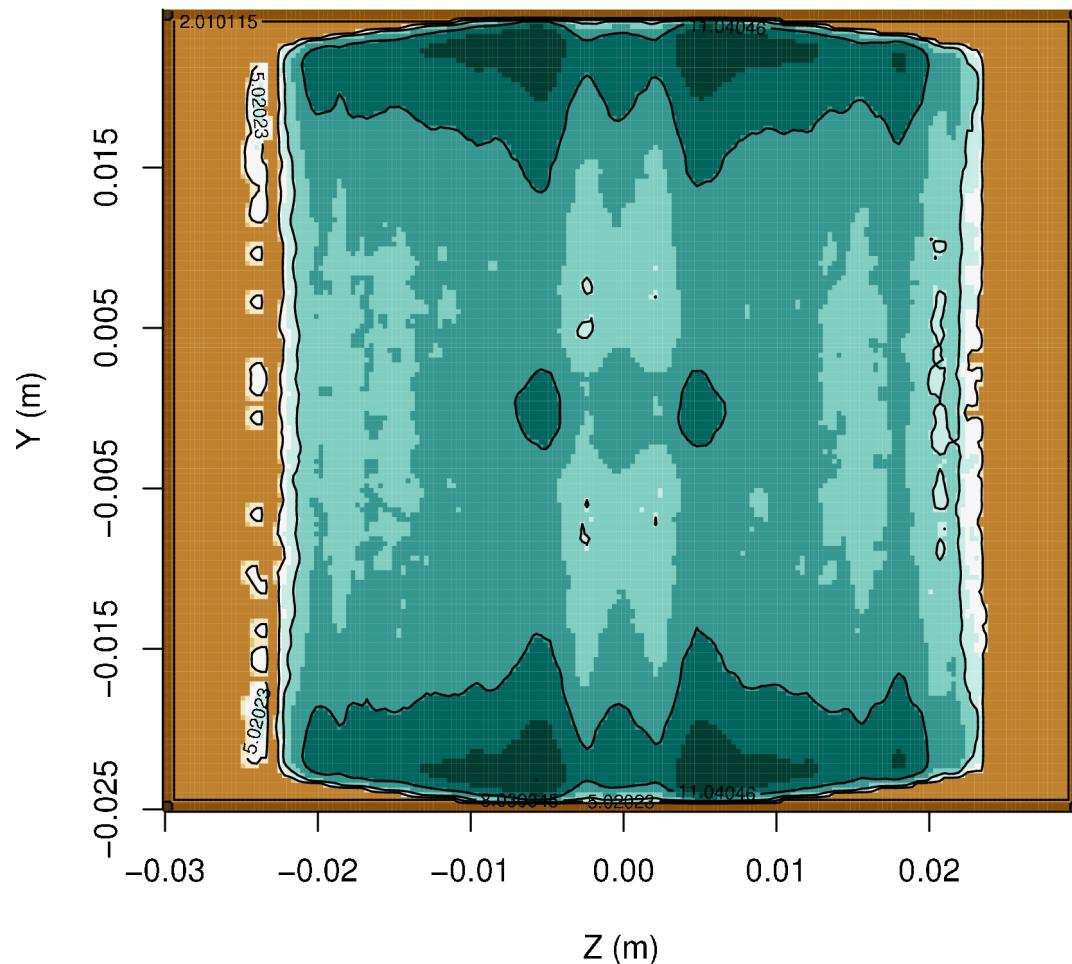


In the relaxed state...

Few ns after the bunch
has gone through

Fact or 3 density change
Along the Z axis...

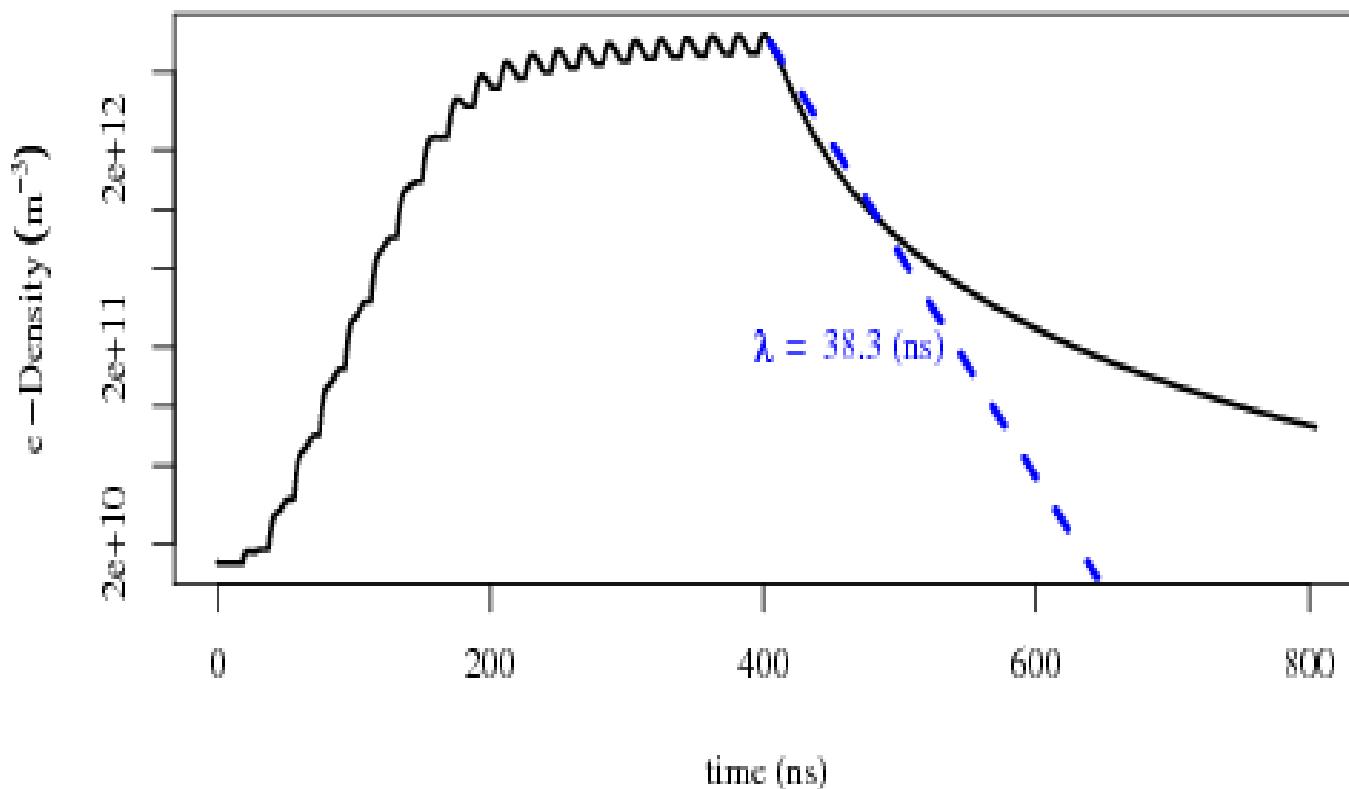
Transverse Profiles



Accelerated,
When the bunch is close by..

Electrons are captured,
Then released.

Life time of e-cloud



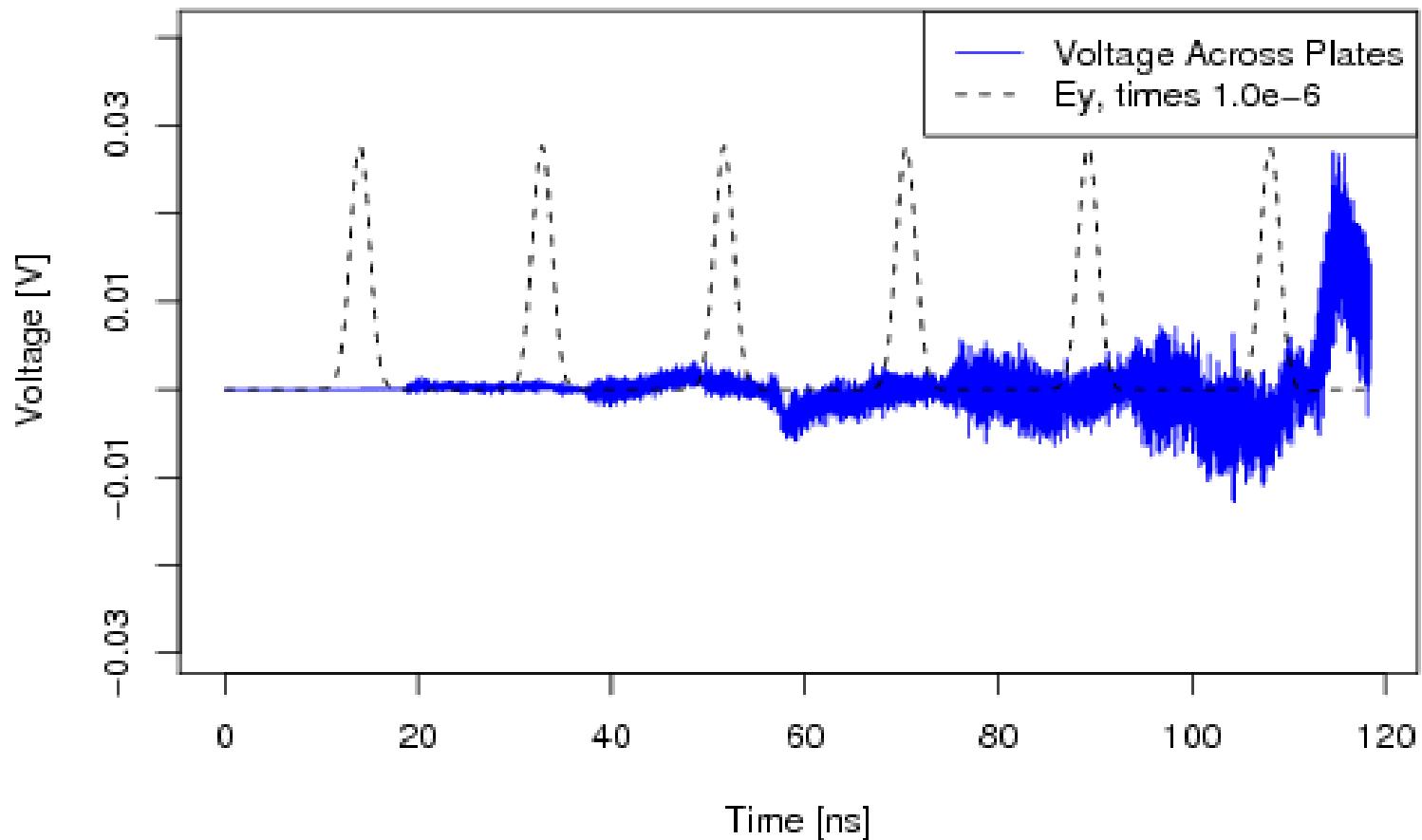
The e-cloud will
Survive a few empty
Bunch

Not enough CPU cycle
To track the e-cloud
For 1 to 2 μsec , across
Abort gap.

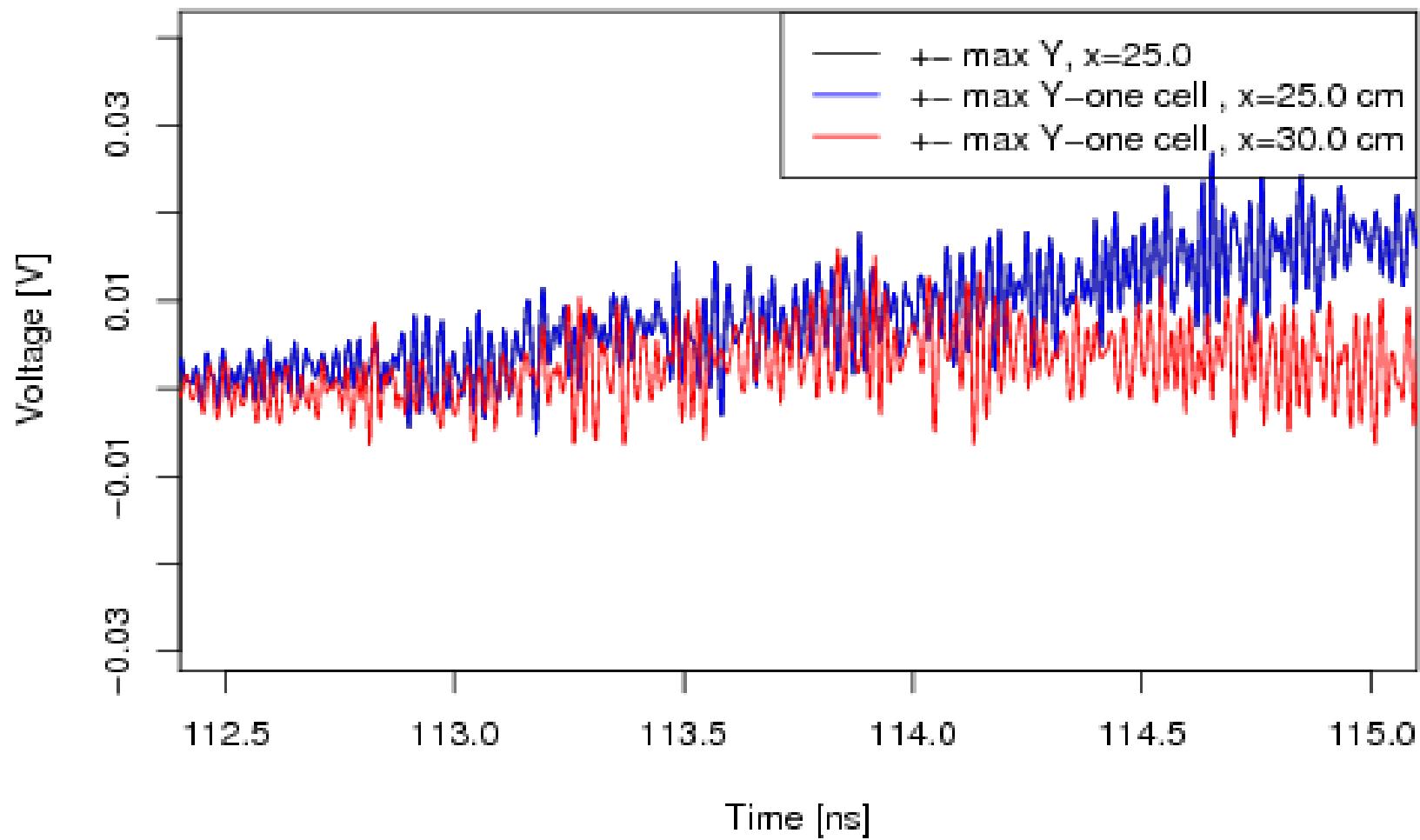
And result very sensitive
To parasitic field.

Back to microwave experiment..

- PAC09 status.
 - Assume the probe measuring the e-field is very small compare to the size of the pipe. => only E field, not... Efield very noisy, kV/m => Amplitude modulation likely.
- Now:
 - Compute the “VORPAL Pseudo Potential” across the top and bottom of the beam pipe.
 - For a centered beam => big cancelation !.



To be continued.... (saturation incomplete..) Yet, expected ~ 1 volt



Request for Ampl. Mod. Measurement.

- If beam is perfectly centered, small amplitude modulation, as the integral of $Eydy$ across the BPM strip line gap vanishes. (and apologies for earlier confusion about what's really measured..)
- If we see a bit of amplitude modulation, please, put the beam orbit a bit off in Y, (vertical bump) and you should see more amplitude modulation...

Next steps.

- Study other beam pipe materials..
 - Very costly in VORPAL: need DOE Phase I funding.. But a cheap kludge possible!..
- Move to bigger computer, run with a longer beam pipe..
- Restore the microwave field... Analyze the pseudo potential instead of highly localized E_y fields.
- Write paper???